REVIEW

Management of acute heart failure in elderly patients

La prise en charge de l’insuffisance cardiaque aiguë chez les patients âgés

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Summary  Acute heart failure (AHF) is the most common cause of unplanned hospital admissions, and is associated with high mortality rates. Over the next few decades, the combination of improved cardiovascular disease survival and progressive ageing of the population will further increase the prevalence of AHF in developed countries. New recommendations on the management of AHF have been published recently, but as elderly patients are under-represented in clinical trials, and scientific evidence is often lacking, the diagnosis and management of AHF in this population is challenging. The clinical presentation of AHF, especially in patients aged > 85 years, differs substantially from that in younger patients, with unspecific symptoms, such as fatigue and confusion, often overriding dyspnoea. Older patients also have a different

Abbreviations: AHF, acute heart failure; BNP, B-type natriuretic peptide; CCU, cardiac care unit; HFrEF, heart failure with preserved ejection fraction; HFpEF, heart failure with reduced ejection fraction; ICU, intensive care unit; NT-proBNP, N-terminal pro-B-type natriuretic peptide; SpO₂, peripheral oxygen saturation.

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Background

Acute heart failure (AHF) is the term used to describe the rapid onset of symptoms and signs of heart failure [1]; it is a life-threatening condition with substantial short- and long-term mortality [2], which requires rapid diagnosis and treatment delivery to relieve symptoms and improve outcome.

AHF is currently the most common cause of unplanned hospital admissions in patients aged >65 years in the Western World. The average age of patients admitted for AHF is 75 years, and specialists in geriatrics are increasingly involved in the interdisciplinary management of patients with AHF. Over the next few decades, the prevalence of AHF will increase further, especially in elderly patients, because of the combination of improved cardiovascular disease survival and progressive ageing of the population in developed countries [3].

New recommendations for the management of patients with AHF were published recently [4]. "Young" (aged <64 years) and "middle old" patients (aged 65–74 years) represent the typical AHF population, and can be managed according to general guidelines [1,4]. However, because "old old" patients (aged 75–84 years) and, in particular, with increasing age, "oldest old" patients (aged >85 years) differ substantially from younger patients in terms of the clinical characteristics of AHF and the prevalence of co-morbidities, disability and frailty, a reappraisal of the topic, with a special focus on elderly patients, is warranted.

In the present paper, we review current evidence and, as older patients are under-represented in clinical trials and evidence for an optimal treatment option for this special subgroup is lacking, we have added expert opinion, to provide guidance to practicing physicians and other healthcare professionals involved in the management of elderly patients (aged >75 years) with AHF.
Methods

First, we created a group of experts composed of three senior clinicians (a cardiologist, a geriatrician and an intensivist), who determined, by consensus, the chapters that must be included in the paper. Next, two of these experts (the cardiologist and the geriatrician) searched the PubMed database for publications from the past 10 years (2005–2015), using a combination of the keywords "frailty", "elderly", "acute heart failure", "diagnosis" and "prognosis", and then selected the articles according to the following schema: firstly, after reading the abstracts; secondly, after reading the titles; and finally, after reading and analysing the articles in full. At each iteration, the decision was taken by consensus.

Clinical presentation of AHF in elderly patients

The clinical presentation of AHF in elderly patients differs significantly from that in younger patients. Patients with AHF aged >75 years are more likely to be women and to have heart failure with preserved ejection fraction (HFrEF) compared with younger patients with AHF [5]. Moreover, the proportion of patients with HFrEF seems to have increased in recent decades. Patients with HFrEF have similarly poor outcomes to patients with heart failure with reduced ejection fraction (HFrEF), but, in contrast to HFrEF, no effective disease-modifying treatment for HFrEF has been found so far. More interestingly, patients with HFrEF have a significantly higher burden of non-cardiac co-morbidities and mortality arising from non-cardiovascular causes compared with those with HFrEF [6].

The typical presentation of AHF includes symptoms and signs of congestion associated with normal or elevated blood pressure [7]. The presence of exertional dyspnoea, orthopnoea, paroxysmal nocturnal dyspnoea, increasing bodyweight and peripheral oedema corroborate the diagnosis of AHF. With increasing age, however, atypical clinical presentations become more common, and may delay a correct diagnosis. Indeed, many of the elderly may not have dyspnoea because of their sedentary lifestyle, and report only fatigue or exhibit an altered mental state [8]. Co-morbidities and/or cascading multiorgan failure may also substantially influence the clinical presentation [9]. Table 1 summarizes the main differences in clinical characteristics between AHF patients younger and older than 75 years.

| Table 1 Comparison of typical acute heart failure clinical characteristics between age groups. |
|---------------------------------|-----------------|-----------------|
| **Epidemiology**                | Age < 75 years  | Age ≥ 75 years  |
| Incidence                       | < 0.2%          | > 4%            |
| Prevalence                      | < 5%            | > 10%           |
| Sex predominance                | Male            | Female          |
| One-year mortality              | < 20%           | > 20%           |
| **Predominant co-morbidities**  | Cardiovascular risk factors | Cognitive impairment |
|                                | Chronic kidney disease | Loss of autonomy |
|                                | Pulmonary disease |                 |
| **Precipitating factors**       | Hypertension    | Malcompliance   |
|                                | Acute coronary syndrome | Pulmonary infection |
| **Predominant symptoms**        | Dyspnoea        | Fatigue         |
|                                |                 | Dyspnoea        |
|                                |                 | Confusion       |
| **Diagnostics**                 | Normal cut-offs | Age-adjusted cut-off |
| Natriuretic peptides            | Often < 40%     | Often > 40%     |
| LVEF                            | Classic signs of pulmonary congestion | Often non-specific findings |
| Chest radiography               |                 |                 |
| **Therapeutic interventions**   | Diuretics/vasodilators | Tailored doses |
| Decongestive treatment          | Frequent        | Frequent, use with caution |
| Non-invasive ventilation        | Rare            | Frequent        |
| Palliative intent               |                 |                 |
| **Preventive interventions**    | Improved survival | Improved quality of life and autonomy |
| Primary target                  | Reduction of readmission |                 |
| Mode of action                  | Optimal medical and device therapy | Geriatric rehabilitation |
|                                | Cardiac rehabilitation | Nutritional counselling |
|                                | Patient empowerment | Multidisciplinary approach |

LVEF: left ventricular ejection fraction.
Triage of AHF in the elderly

The initial evaluation of elderly patients presenting with AHF should, as for younger patients, not exceed 30–60 min and should focus on cardiopulmonary status to exclude haemodynamic instability and respiratory distress (Fig. 1). Systolic blood pressure > 90 mmHg, heart rate < 40 or > 130 beats/min, severe arrhythmia, increased blood lactate concentration (> 2.0 mmol/L), low central-venous oxygen saturation (< 60%) and clinical evidence of peripheral hypoperfusion (cold and mottled skin, oligura, altered mental state) indicate haemodynamic instability. Precise evaluation of mental state in emergency situations may be challenging, especially in elderly patients with pre-existing neurological impairment.

Initial diagnostics and therapy should be tailored according to the findings of the initial evaluation. Patients with cardiogenic shock should immediately undergo transthoracic echocardiography, and be transferred to an intensive care setting (intensive care unit [ICU] or cardiac care unit [CCU]) [4]. Urgent heart catheterization should be considered for patients presenting with acute coronary syndrome.

Respiratory distress is defined as elevated respiratory rate > 25 breaths/min, low peripheral oxygen saturation (< 90%) despite oxygen supplement or increased breathing work. Oxygen therapy should be started and, if respiratory distress persists, non-invasive ventilation should be initiated, and the patient should be transferred to the CCU/ICU. Patients without signs of cardiopulmonary distress may be treated initially in the emergency department.

Figure 1. Algorithm of the initial management of elderly patients with acute heart failure (AHF). The initial management of elderly patients presenting with AHF should not exceed 30–60 min. During the initial evaluation, cardiopulmonary status should be evaluated (focusing on symptoms and signs of haemodynamic instability or respiratory distress) and a rapid geriatric assessment should be done (covering frailty, disability, relevant co-morbidities and the patient’s preferences for care). Initial diagnostics and therapy should be tailored according to the findings of the initial evaluation. Patients with cardiogenic shock or signs of cardiopulmonary distress should immediately undergo transthoracic echocardiography (TTE) and be transferred to an intensive care unit (ICU) or cardiac care unit (CCU). Urgent heart catheterization should be considered for patients presenting with an acute coronary syndrome. Patients without signs of shock or cardiopulmonary distress should receive additional diagnostic tests to confirm the diagnosis, and should receive initial therapy according to blood pressure at admission. Intravenous diuretics are recommended to relieve congestion; patients with systolic blood pressure > 110 mmHg should receive additional vasodilators. Patients with severe co-morbidities and/or poor functional status should be considered for palliative care. Cath lab: catheterization laboratory; ECG: electrocardiogram; Echo: echocardiography; Ev.: Evaluation in a catheterization laboratory; HR: heart rate; O$_2$: oxygen; RR: respiratory rate; RX: radiography; SBP: systolic blood pressure; ScvO$_2$: central-venous oxygen saturation; SpO$_2$: peripheral oxygen saturation.
In addition to cardiopulmonary status, the initial evaluation of elderly patients should also include a rapid geriatric assessment to determine three inter-related entities (frailty, disability and relevant co-morbidities) which could be important to determine the degree of aggressive treatment that can reasonably be proposed (curative or palliative) to a particular patient. Frailty reflects a state of vulnerability to stressors secondary to a decreased physiological reserve. Frail AHF patients have a higher risk of complications, prolonged recovery, readmission, disability and mortality. There is no definitive gold standard test for frailty yet, but plenty of tools exist that reflect one or more of the five distinct domains of frailty: slowness, weakness, low physical activity, exhaustion and shrinking. Co-morbidities and disabilities (difficulties in performing activities of daily living) are erroneously interchanged with frailty in many instances. However, disabilities are rather adverse outcomes associated with frailty.

The presence of frailty, disability or co-morbidities should not be viewed as an absolute reason to withhold care, but rather as a means of delivering it in a more tailored fashion, considering the patient’s preferences for care, including their advance directive, if available.

Indeed, palliative care should be considered at an early stage in geriatric patients, to avoid unnecessary and harmful diagnostics and treatments. Early transfer to a dedicated palliative care unit, and delivery of the appropriate symptomatic treatment to reduce dyspnoea, pain and anxiety are associated with improved patient and family satisfaction and decreased health care utilization.

**Diagnosis of AHF in the elderly**

Natriuretic peptides are recommended for the evaluation of cardiac origin of acute dyspnoea, as they increase diagnostic accuracy in AHF and provide prognostic information. Elevated levels of natriuretic peptides support the diagnosis of AHF in elderly patients with acute dyspnoea, but interpretation of the plasma concentrations may be more difficult than in younger patients. Indeed, cut-off values for elderly patients, in particular those aged > 85 years, are different to those for the general population, and the “grey zone” (defined as the range between the exclusionary cut-off and the confirmatory cut-off) is wider. The proposed grey-zone values for B-type natriuretic peptide (BNP) and N-terminal pro-BNP (NT-proBNP) are 250–590 pg/mL and 1750–6000 pg/mL, respectively, for patients aged > 85 years. Regarding the value of natriuretic peptides, particularly the amino-terminal fragment, in guiding treatment, it seems that patients aged ≥ 75 years do not benefit from NT-proBNP-guided therapy, unlike younger patients. High-sensitivity troponin tests are recommended to exclude ongoing myocardial ischaemia, but their interpretation is also challenging, as AHF itself is associated with increased troponin concentrations. Indeed, elevated troponin concentrations are associated with more severe AHF with an adverse prognosis. Blood count, electrolytes and kidney and liver function should also be routinely tested to assess co-morbidities and end-organ injuries (e.g. cardiorenal or cardiohepatic syndrome), which may substantially influence short- and long-term outcome.

**Treatment of AHF in elderly patients**

Each episode of decompensation is known to substantially worsen the long-term course of heart-failure patients. Treatment strategies should therefore be focused not only on relieving symptoms, but also on improving survival in those patients not directed to palliative care. Several studies have emphasized the importance of early diagnostics and treatment delivery in AHF. For this purpose, a “time-to-treatment” concept, similar to that for acute coronary syndrome, has recently been proposed. Thus, the recent recommendations state that appropriate treatment delivery should start within 30 min after the first contact with a physician, and that treatment should be started without unnecessary delay caused by additional investigations.

Decongestive treatment should be started as soon as AHF is suspected. Oxygen therapy, diuretics and/or vasodilators are the baseline medications in AHF patients with normal or high blood pressure. Intravenous loop diuretics are the most commonly used decongestive AHF treatments, but few data exist on the optimal dose. In the DOSE trial, no significant differences in patients’ global assessment of symptoms or in the change in renal function were found when diuretic therapy was administered by bolus compared with continuous infusion or at a high dose (2.5 times the usual oral dose) compared with a low dose (equivalent to oral dose). However, a non-significant trend towards increased renal dysfunction in the high-dose group was observed. This could be of concern in elderly patients with pre-existing impaired renal function. Therefore, diuretics should be limited to the smallest amount necessary to provide clinical effect.
furosemide bolus of 40 mg or equivalent to the oral dose taken previously until admission should be considered as initial treatment. Daily furosemide doses exceeding 160 mg have been associated with an increased risk of death [26]. In patients not responding to conventional diuretic dosing, a combination of a loop diuretic with thiazide or another class of diuretics may improve the diuretic effect, but may sometimes induce electrolyte disarrangement [27]. The clinical management of a patient with cardiorenal syndrome includes the challenge of diuretic resistance caused by more frequent or higher doses of intravenous boluses of diuretics or combination with thiazide or continuous intravenous furosemide infusion [28].

In patients with systolic blood pressure > 110 mmHg, vasodilators should be added to diuretics to achieve more rapid decongestion. Inotropes, particularly catecholamines, should be avoided in patients without signs of hypoperfusion or cardiogenic shock, as they do not improve outcome and their use may be associated with increased morbidity and mortality [29]. Oxygen therapy should be provided in patients with peripheral oxygen saturation (SpO$_2$) < 90%. In patients with respiratory distress not responding to the initial treatment, non-invasive ventilation, which has been shown to decrease intubation rates and to improve the early outcome of patients with acute cardiogenic pulmonary oedema, should be initiated [30]. However, in presence of diastolic dysfunction or right heart failure, positive pressure ventilation treatment may lead to haemodynamic deterioration.

In addition, patients should receive appropriate symptomatic treatment to reduce dyspnoea, chest pain or anxiety. Morphine efficiently reduces dyspnoea, but should be used with caution, as it has not been shown to improve outcomes; rather, it is associated with an increased need for invasive mechanical ventilation and ICU admission, and even increased mortality [31].

In the context of early treatment initiation, optimal prehospital management plays a central role in AHF treatment. Non-invasive monitoring (continuous electrocardiogram, blood pressure, peripheral oxygen saturation, respiratory rate) should be performed during transport to hospital. Oxygen therapy should be provided in the presence of hypoxaemia (SpO$_2$ < 90%) and, if not relieved, non-invasive ventilation should be started, if available. Decongestive treatment with diuretics and/or vasodilators may also be started during the prehospital phase, if AHF is suspected, but in elderly patients with pre-existing intravascular fluid depletion, special attention should be paid to avoid overlooking other causes of dyspnoea, which may be aggravated by diuretic administration (e.g. pulmonary infection, severe anaemia). Prehospital management should not delay rapid transfer to the hospital [32].

**Palliative care for elderly frail patients with heart failure**

Palliative care is multidisciplinary, and its core components include alleviation of both physical and psychological symptoms, support for spiritual concerns and expert communication to establish the goals of care [33]. In AHF, medical treatment consists largely of the conventional medical classes, including diuretics, vasodilators, opioids and oxygen, but rather than aiming to improve survival, its objective focuses on improving quality of life. Therefore, additive treatment and monitoring that cause discomfort should be questioned. Oxygen treatment appears to be superior to room air in relieving dyspnoea only in patients with hypoxia [34]. In addition to small-dose opioids, benzodiazepines may reduce the anxiety associated with breathlessness. Pain is common, but is often undertreated in end-stage heart failure. Opioids are used as first-line treatment, starting with short-acting agents and then switching to sustained-release preparations when total daily requirements are determined. Oral or transdermal nitrates and other vasodilators are effective for treating anginal pain. Non-steroidal anti-inflammatory drugs should be avoided because of the risk of fluid retention, renal failure and gastrointestinal bleeding [14].

**Hospital discharge and outpatient management**

Continuous monitoring and reassessment of clinical response to initial treatment should continue for 2–3 h after admission. During this phase, treatment doses should be adjusted based on clinical response. Every attempt should be made to initiate disease-modifying oral therapies (angiotensin-converting enzyme inhibitors, beta-blockers, mineralocorticoid-receptor antagonists) after initial decongestion in patients with de novo AHF, and to continue chronic medication in patients with pre-existing chronic heart failure. The decision about the final destination of AHF patients (transfer to normal ward versus ICU/CCU versus home discharge) can be made within 2–3 h after admission, according to the clinical scenario.

Readmission rates in AHF remain high, particularly in the first months after discharge, and, as discussed above, each hospitalization is associated with an adverse prognosis. In the study by Tuppin et al. [35] who collected information from the national health insurance information system about hospitalization in France in 2009, it was found that the 2-year all-cause readmission rate was particularly high (69%), and remained stable according to age.

In elderly patients, the decision to hospitalize may be even more challenging: successful home discharge may be influenced by co-morbidity, functional status, body composition, treatment and several factors not directly related to heart failure [36]. In addition, the length of hospital stay should be as short as possible, to limit the negative impact of hospitalization (physical deconditioning, iatrogenic complications) on this particularly frail population. To determine the optimal time of discharge, several tools and checklists have been proposed to help clinicians, including reduction of signs and symptoms of congestion (Fig. 2): subjective and objective improvements in cardiological status (improvement in dyspnoea, decrease in heart rate to < 100 beats per minute, SpO$_2$ > 92% on room air, absence of orthostatic hypotension, adequate urine output, stable kidney function for at least 24 h and improvement in the plasma concentrations of natriuretic peptides).
The transfer of elderly patients with AHF, after management in the emergency department, must take into account the presence or not of a significant decrease in functional capacity (activities of daily living), cognitive status and active co-morbidities. The frail elderly should receive care in an acute geriatric unit rather than in a cardiology unit.

Older patients should, in addition, undergo multidimensional comprehensive geriatric assessment before discharge [37]. Geriatric assessment is a global technique, which must be made at steady state by a multidisciplinary team trained in care of the elderly; it is based on clinical (medical history), functional (Katz Index of Independence in Activities of Daily Living), cognitive (Pfeiffer Short Portable Mental Status Questionnaire), affective (short-form Geriatric Depression Scale) and social aspects of care [38,39]. This overall evaluation will assess the presence of functional deterioration and the consequent need for multimodal rehabilitation, in order to reduce hospital length of stay and fight against physical deconditioning and loss of autonomy.

Finally, elderly patients with heart failure may benefit from a multidisciplinary disease management programme and outpatient heart failure clinics, in addition to the usual care provided by general physicians and cardiologists, to reduce readmission and mortality rates [38].

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